# THE DESIGN OF BUSINESS AND SAFETY MODEL IN OIL DISTRIBUTION DEPOT
## (Implementation: Real Time Strategy of Simulation Game)

Y. ADAM PRASETYO
*Information System Department, Industrial Engineering Faculty, Institut Teknologi Telkom*

## ABSTRACT

*Learning method for training continues to grow together with the development of technology. One of the methods is the use of games as a training employees medium. The use of games for education will be an effective method for training new employees. The characteristic of game is as a simulation for simulating the real system. The simulation system will be related to modelling system.*
*The main purpose of the research is to get the integrated business and safety model in oil distribution depot for simulation modet. The making of business and safety model needs an intensive research to get an integrated model. So, the developed method must be got from the real system. The research methodology is simulation modelling. The model has implemented in real time strategy game simulation.*
*Researcher has conducted research to produce a business and safety model in Oil Distribution Depot. The model has been validated using focus group method by the competent experts. The result of research shows that the designed model is good and eligible to represent business and safety in the Oil Distribution Depot system significantly.*
*The implementation of this model could be used dor model of training simulation game. This model can be use to give understanding for user who playing this simulation game about business and safety simultaneous and the interaction between them. Future research will be develop the model more detail and implementation model for different sectors.*

**Keywords**: model, business, work safety, simulation modelling, simulation games, oil distribution depot.

## INTRODUCTION

Simulation game is an alternative method for education method. Simulation game does not depend on the promoter or trainer in delivering training materials. However, the training simulation game will be learned by the employees themselves without the time-binding. The promoter only need do a design-related training materials and provide to the employees to be learnt interactively and fun.

Safety work and business in the oil distribution depot can be seen using a systemic perspective. Each component in the system will influence and impact each other in business and safety work process. The business and safety work system design becomes a essential case in simulation game if it is supposed to be an effective simulation game. It not only gives an excitement but also learning for those who play it.

Related to what been explained above, the main problem is how to get the integrated model of business management and safety work in oil distribution depot. The developed model is expected to be a representative a real system in oil distribution depot. Thus, the implementation of this model can bea framework for other specific purposed – other application development.

## LITERATURE REVIEW

### Learning Model Development Foundation

Riis (1995) explains that a education purposed - simulation game can teach the players about awareness, understanding, and knowledge from the simulated system. The main purpose of education is to provide the interaction information in the simulated systems process. It can be used to provide an understanding regarding to the supply-chain (chanelling) and the importance of how the perspective of macro system.

Simulation game is an alternative learning method that is currently developing. The learning method changed from the conventional method of teaching patterns to the base of simulation game. Comparisons between them can be seen in Table 1.

Tabel 1 More Detailed Comparrison of Teaching Methods [4].

| **Paradigm** | **Conventional** | **Simulation games** |
|---|---|---|
| Teacher's Role | Agent | Promoter |
| Student's Role | Receptif | Active |
| Contents | Predominantly Theoritical | Real |
| Motivation to learn | Contents Sequences | Curiosity, desire to solve problem |

Based on the taxonomic category of Herz, simulation game is a combination of simulation and strategy game.

**Business Model Development Foundation**

Business processes in manufacture companies include manufacturing and management. (Davenport, 1993) [11]. The processes include as follow:

1. Operational processes, which include:
   - product development,
   - customer acquisition,
   - customer requirement identification,
   - manufacturing,
   - integrated logistic,
   - order management,
   - post-sales service

2. Managerial processes, which include:
   - performance monitoring,
   - information management,
   - asset management,
   - human resources management,
   - planning and resource allocation.

In addition, there are also cycle management processes in manufacturing companies, which include:

- equipment life cycle management,
- human resource life cycle management,
- product life cycle management,
- cash flow management,
- Material flow management.

**Safety Model Development Foundation**

Business and safety is an inter-related process. Game simulations can help to provide an information system that the conditions are in danger. This can help the employees to understand as the players how important workplace safety is. The employees can understand it without experiencing by themselves. Simulation games of workplace safety do not replace the existing safety training but improve the training effectiveness. In existing training media which use audio, video and text in teaching, and the real simulation, it can be also mixed into the simulation game. It hopes that it can increase teaching effectiveness and decrease indoor training intensiveness.

The State-of-the art safety engineering for safety[6] can be seen below.

1. Hazard Analysis
   Hazard Analysis is used to identify accidents that occur in designed system. It will ultimately determine priority of emergency accident, intensity and fire overcoming method.
2. Safety Requirements Specification and Analysis
   At this stage, the analysis done is determining the type of safety equipment and safety systems design. It is related to the needs of equipment and systems for accident prevention and response.
3. Designing for Safety
   In the design of safety, software engineering is needed for prevention (detection) and response when the accident occurs.
4. Testing
   Stage of testing is to demonstrate whether the software is the designed software is responsive to the accident that occurred or not. Testing results are measurement results on the safety modeling system. The results include the error and reliability of software.
5. Certification and Standards
   Although there are many characteristics of safety and health software, but it is quite important to have international standards.
6. Resources
   Resources are related to technical resource literature in the safety and health system design. Workplace accident can be defined as death, injury, illness, damage or loss of assets (property) or damage to the environment.

## RESEARCH METHODOLOGY

Model is a representation of a real system that has been simplified and adapted for a particular purpose. Design and test a used model in simulation study can be done in several stages. The phases can be seen in Figure 1. The phases of simulation modelling can be described in detail as follow:

1. Problem Formulation
   Each modelling starts with problem formulation which must be set correctly. It must be defined and approved by the client. However, problem determination may change based on literature studies on the future and agreed by the client.
2. Objectives determination and planning process
   The next stage is the determination of goals and planning process. Determining the purpose deals with several questions that must be answered in the simulation study model. Project planning design can be a scenario that should be investigated.
3. Model Design
   If project settlement planning has been approved, then can be continued to model planning phase. Based on picture 2 above, the phase consists of model conceptualization and data collection.
4. Model conceptualization
   The real system will be investigated to make conceptual model. In this stage, the conceptual model can be a collection of mathematical formulas and relationships between components in the system. The modelling can be started from making a simple model to get a highest complexity. The method to create this conceptual model is by doing analysis and modelling simulation.
5. Data collection
   Data collection deals with the determination of the required data in defining the existing process.
6. Model Translation
   Translation stage is a model for implementing the simulation model into an application with the computer programming. Model programming can be simulated using a high-level programming language (Banks et al., 2000; Schriber, 1990). Programming includes a high level programming language such as Visual Basic, C + +, FORTRAN, and Pascal. One of

the aspects of the election programming languages is the ability to meet the adequate graphics spefification level required in model implementation.

7. Verification
   Verification phase is a phase to evaluate whether the simulation application made run based on model design result. This step is related to the evaluation on the effectiveness of application programming codes.
8. Validation
   Validation is an evaluation phase whether the model made represents the fact system.
9. Experimental Design
   This is the stage to run the application. The number of applications to determine an output form produced by the simulation application.
10. Running production and analysis
    This stage is to run the simulation model to obtain an issued output. The output from the simulation will be used for the next stage evaluation.
11. Trials evaluation
    The evaluation in this phase is to see whether it is still needed more trials or not.
12. Documentation and reporting
    Documentation and reporting is used to run some purposes. One of them is to ease future application development or to be able to implement to other applications.
13. Implementation
    The simulation deals with reporting and other supporting decision maker. If all phases above are correctly accomplished and agreed by the clients, a good result will be got.

## DESIGN AND IMPLEMENTATION

**Business Model**

The analysis and business modeling development of oil distribution depot is based on the concept of business processes in manufacturing companies (Davenport, 1993) [11]. The process includes business process and management. The analysis is explained as follow:

1) Operational Process
   The characterictics of operational process based on product development, the acquisition or the increase of customers number, the identification of customer needs, manufacturing, supply integration, the demand, and sales service. Here are the further explanations about the result of analysis of operational process characteristics:
   - Product Development
     Products that are implemented in the design simulation model is a premium (PM), pertamax(PX), solar (SO) and oil (MT). The products are the main products which are managed by Pertamina.
   - Customer Acquisition
     The coming of customers number is determined by SPBU order to Pertamina. Tank car will send the products to the SPBU. SPBU demand is determined by the customer order. Currently, there are already several companies have permission to sell a similar product. These companies are competing each other in speed, quality, service and others. SPBU order to Oil Distribution Depot indirectly influenced by customers demand. Thus, customer satisfaction is also influenced by the performance of the oil distribution depot. Based on the fact above, the customer is determined by the satisfaction of customers and company's brands.
   - Customer need identification
     SPBU customer needs are premium, pertamax, and diesel. These three products dominate the major customer needs because kerosene use has been reduced.
   - Manufacture
     Manufacturing process in the oil distribution depot is filling tank and shed to meet the demand of coming tank cars. The filling process flow consists of three parts:
     1. pipes have a function for distributing the oil from one place to another,
     2. hoarding tank functions as a storage area with a large capacity,
     3. filling shed works to save fuel in a small capacity to be distributed to vehicle tank,

4. Controlling room functions to control the process in hoarding tank, filling shed and pipe. The process can be generally seen in Figure 1.

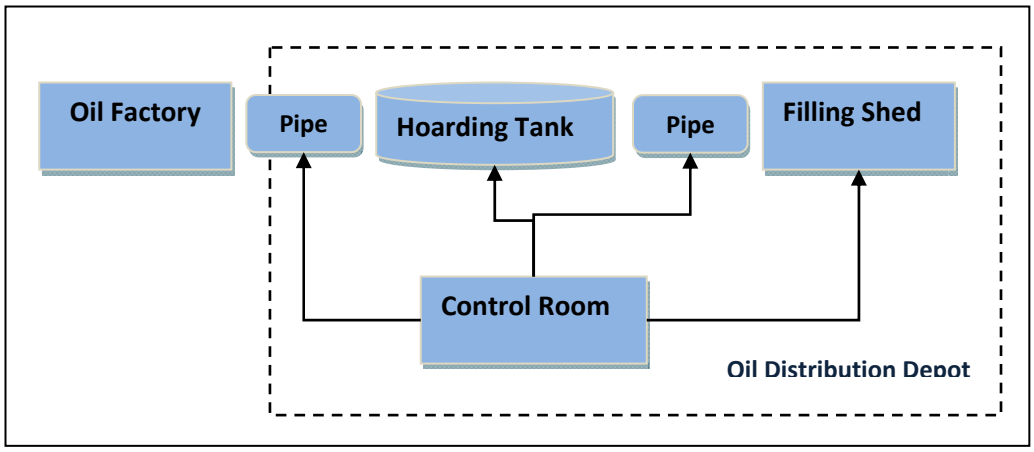

Figure 1 Operations of oil distribution depot

Although there are a lot of depot operations, the making of model has been suited based on the need to provide the business system understanding and RTS game type. So, the flow is simplified from hoarding tank to filling shed without using pipes and controlling room.

- Integrated logistic
  Depot has 2 types of supply relating to operational process. The types are related to the supply of safety equipment and fuel.
- Order management
  Order management deals with the demand of fuel and safety equipment needs to support operations. The supply should be met when needed so that business processes run well. So, the supply and demand supply must run well in this process.
- Sales service
  The sales service of company needs long process, it starts from fuel order management , tank car filling management, service, and many more. The location becoming an important attention is about the interaction between tank cars and customers in filling shed.

2) Managerial Process
   The aspects that underlie the process of managerial are working, information management, asset management, human resources management, and resources planning allocation. Here is the detailed explanation relating to the analysis result of manajerial process of system analysis.

- Performance monitoring
  System performance is influenced by employees' performance and equipment effectiveness. Employees are an important asset of company to run the company. If the performance of employees is low, then the system performance will be low as well. In the model design, the performance is realized in the form of a speed movement and the response in doing next activities. The employees' performance in each part will affect the overall system. If the equipments are in damaged, they cannot function well. As a result, it will also affect the system performance overall.
- Information management
  Status and conditions of employees, assets, processes and customers need managing. Therefore, the data processing associating it need to be processed into an appropriate and useful information. The information is shown to provide benefits to doers in running operational depot well.

- Asset Management
  The assets of company become one of important support. The assets include:
  1. control room,
  2. hoarding tank,
  3. filling shed,
  4. pipe,
  5. gate keeper,
  6. main office,
  7. warehouse.

Adjustments to model formulation is to provide understanding about the system of business and working safety, so the asset needed are hoarding tank, filling shed, office and warehouse.

- Human Resource Management
  Humans have many parameters related to individual performance. These parameters can be a physical parameter and mental parameters. In addition to dealing with individual performance, employees have a contribution to the system performance. Regarding to this case, management needs to be done either in individual or in system.
- Planning and resource allocation
  The system consists of many components as depot resources that must be managed well. The resources include depot assets, employees, supplies of fuel and safety equipments. They should be able to support the overall system performance. The simulation of business process is shown in figure 2.

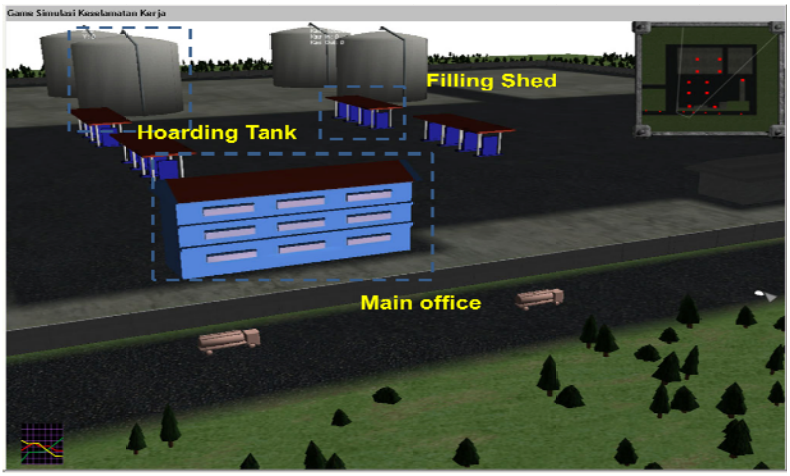

Figure 2 Business process simulation of oil distribution depot

**Safety Model**

1. Hazard Analysis
   To identify accidents that can occur in the design of the system, hazard analysis will determine the emergency priority of accident types and the methods and intensity of fires. Potential operational risks of accidents [14], among others:
   - accidents fire / explosion,
   - result of disease
   - pollution (spillage and leakage),
   - Failure of operation.

2. Safety Requirements Specification and Analysis
   At this stage, the analysis is conducted to determine the type of safety equipment and safety systems design. It is related to the equipment needs and systems for accident prevention and response. The system of safety and equipment and usage as follow:
   - Foam System
     To protect fire in fuel tanks, they are equipped with system to prevent and cope with fires using chemical foam used to cover burning liquid surface.
   - Fire Pump
   - Fire water tub

The fire water tub, made of concrete material and/or entrenchment land, is used to prevent and to put off fire.

- Fire Water Pipe
  It is used as water distribution faciliting fire prevention and response in the Installation / Depot.
- Tools Fire
  To extinguish fire when fire occurs, it is needed some light fire equipments according to existing potential hazards. .
- The Thunderstorms
  It is a tool for distributing the electric current coming from the climate / air change from heat to cold / thunder so the electric current can be forwarded to the earth.

3. Designing for Safety
   In working safety system, software engineering is needed for prevention (detection) and for response when the accident occurs. Protection activities include passive and active protection. Both protections described as follows.
   a. Passive protection include:
      - fire barriers,
      - fire proofing,
      - thermal insulation,
      - separation distances,
      - Drainage system.
   b. Active Protections include:
      - light extinguishing fire equipment,
      - water sprinkler system,
      - Foam system.

As the implementation of model, the system used for fire extinguishing is foam system. The fire simulation of model is shown in figure 3.

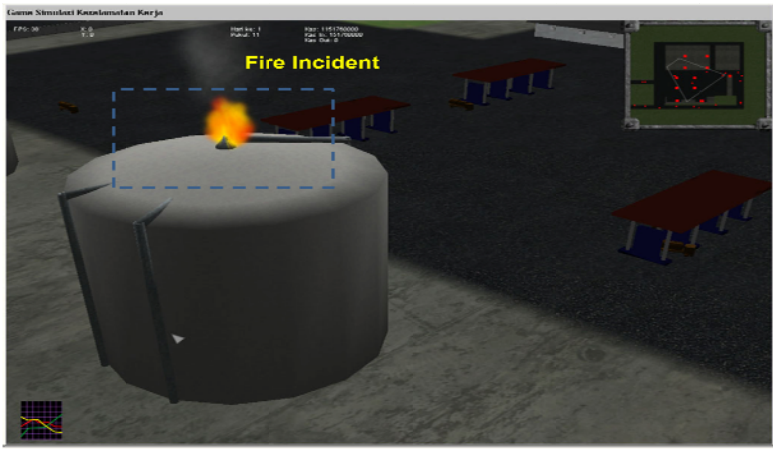

Figure 3 Fire Simulation

The model of simulation business and working safety is represented into three types. They are as follows:

1) Hierarchical model
   Hierarchical model is a structural parameter object suited to management index from developing model. Hierarchical model of business simulation and working safety is shown in Figure 6. In the figur, it can be seen that model of business simulation and safety consists of 6 management types. Each of them are related to object component in model. Each object has independent and dependent parameter. Independent parameter is basic parameter of an object. Meanwhile, dependent parameter is a parameter whose value depends on other parameters, such as employees' working speed, stock, PSI Score, and financial parameters.

2) Object Table
   Object table object is a table containing list of objects with parameter scale of each object type, along with dimensional measurements. In this table includes information concerning parameter types of each object, function, or dimension used for each parameter. The tabel can be seen in Table 2.
3) Hierarchy Score
   Hierarchy score is structure about the influence of each parameter to main score from performance assessment system. Hierarchy score from model of business simulation and safety consists of 2 types, namely profit score / loss score and PSI Score. Table of each score can be seen in Figure 7 is for a profit or loss and Figure 8 is for PSI Score. Perfomance of the system accumulated in balance sheet and income statement which whon in figure

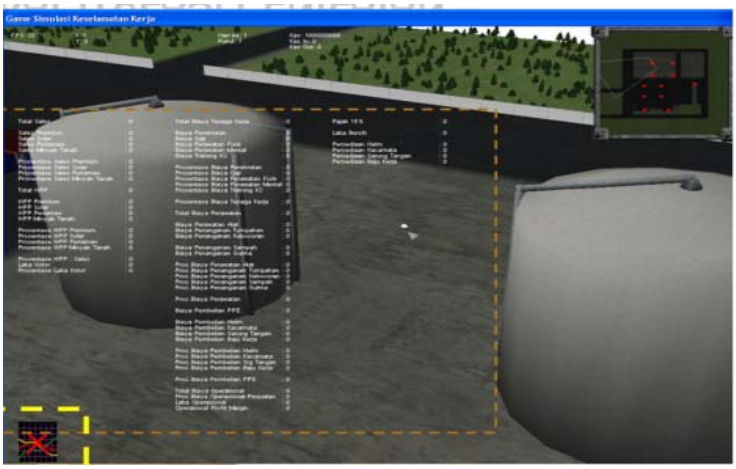

Figure 4 Performance systen

## VERIFICATION AND VALIDATION

Verification is the evaluation process on the translation model. This stage evaluates whether application made has been appropriate with previous application. From 17 functions, there are two functions having changes and two other functions need increasing their visualizations.

In this phase, 16 statements are made as topics that will be discussed and given to the experts. The experts are managerial heads in oil distribution depot. The experts will give their opinion and assessment about the designed model.

There are 16 statements made. The statement consists of 3 aspects of the model assessment, and 13 specific statements about each aspect. Focus group method gives priority to experts' opinion regarding to the model assessment. The following will present a simple statistic assessment to the objectives of experts' assessments. The assessment is to assess the fairness of:

- No 9 statement to the assessment of statement 1 -8,
- No 15 statement to the assessment of statement 10 – 14,
- No 16 statement to the assessment of statement 9 – 15.

The results can be depicted in  in the graph of standard model. Based on model aspects , operation aspects and managerial aspects is considered good and feasible is separately depicted by the experts with 3.33 and 3. The assessment can be seen in Figure 5.

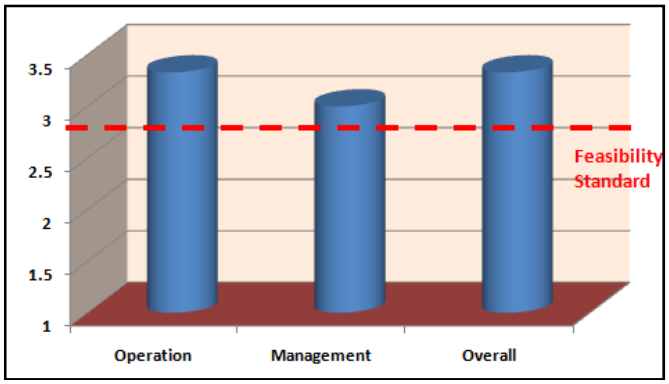

Figure 5 Graphs of the standard model.

## CONCLUSION AND SUGGESTION

### Conclusion

Some conclusions that can be taken based on this research are as follows:

1 simulation model is good and feasible to be implemented in simulation game product,
2 simulation model already had feasibility for representing the real business system and working safety of oil distribution depot,
3 the model designed has met the aspects of operational and managerial oil distribution depot,
4 the integration of business model and safety can give an understanding about interaction between business and safety,
5 the application of business simulation game and safety has been represented well,
6 the model can be applied to develop other applications with different goals but still in the process of oil distribution depot, such as the simulation of emergency accident response, the simulation of tank car distribution, the simulation of fuel material, others.

### Suggestions

Some suggestions that can be given based on this research are:

1 The model designed is a model having the highest modelling so if it will be developed for other purposes, it needs more specific application.
2 The flow changes and automatic depot management process needs implemented in model development and further implementation steps because it has changed the operations as whole.
3 It should be given an improve model and application based on the experts' opinion including:
   - Skip the oil product oil that has been a main product of PERTAMINA depot.
   - Change the use name of filling pump object into filling shed.
   - car tank also has a life cycle that should also be implemented in applications,
   - the changes of depot operation since 2009.
   - Use pipe in the process of material flow because there are many monitoring process activities and safety.
   - Use document information process in application,
   - The process and response of emergency accident needs implementing,
   - The improvement of financial management is not in the profit optimization depot but in the efficiency of operational costs,
   - The development of simulation game application that implements the depot automation process will need more complexity that can lead to the combination implementation of RTS and FPS to support the fact of business system and the working safety of oil distribution depot.

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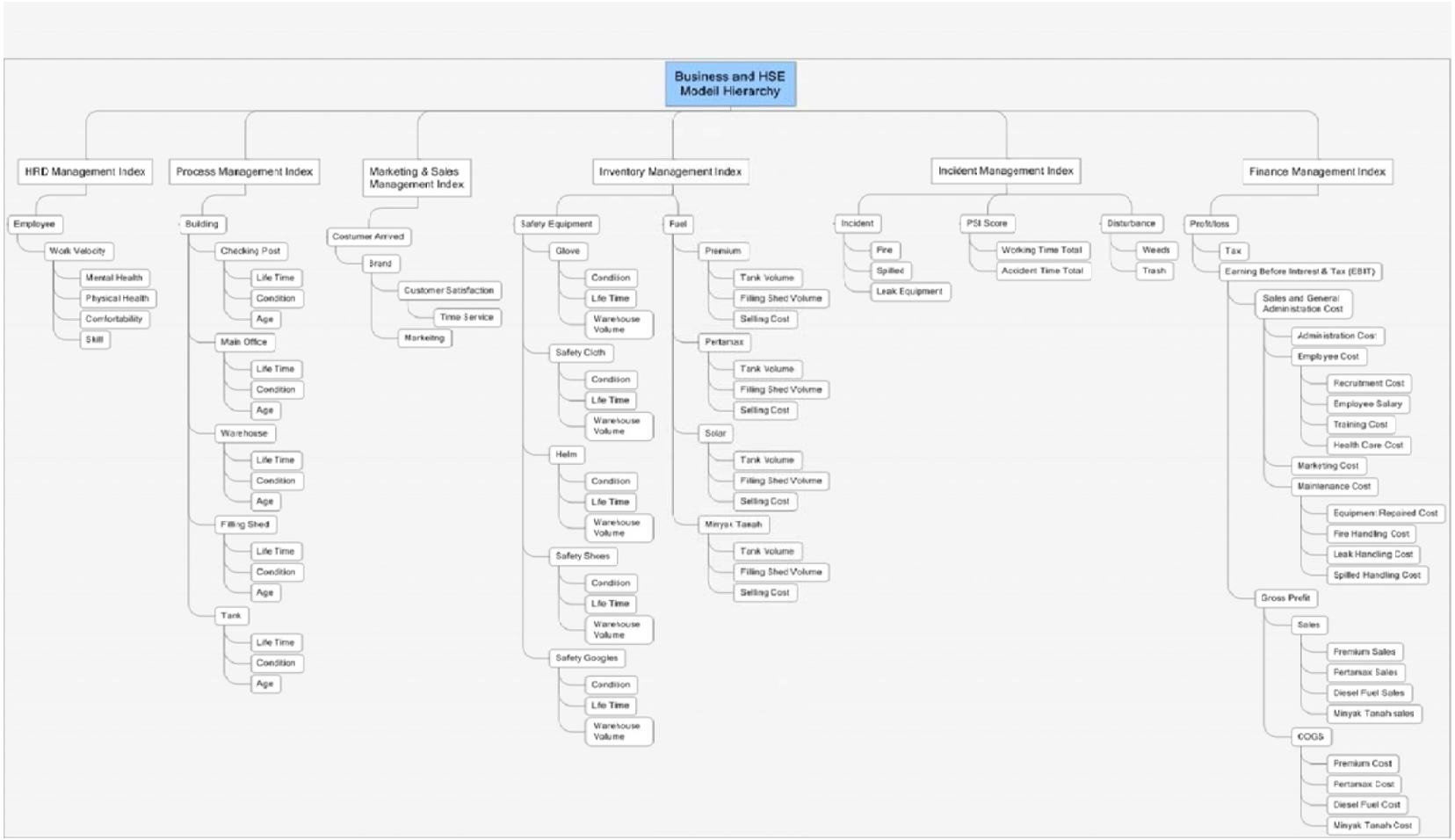


Figure 6 Hierarchy Model and Business Safety Oil Distribution Depot

Table 2 Object Table.

| Object List | Parameter | Function / Unit | Dimension |
|---|---|---|---|
| Employee | Physical Condition | Scale 1000 | competence metrics |
| | Mental Health | Scale 1000 | competence metrics |
| | K3 Awareness | Scale 1000 | competence metrics |
| | Skill | Scale 1000 | competence metrics |
| | Working Speed | equality 3.1 | diagnostic metrics |
| | Employee's salary | rupiah | achievement metrics |
| Office | Condition | Scale 1000 | competence metrics |
| | Life time | Time Function | diagnostic metrics |
| | Age | 25 years | achievement metrics |
| Warehouse | Condition | Scale 1000 | competence metrics |
| | Life time | Time Function | diagnostic metrics |
| | Age | 25 years | achievement metrics |
| | Helmet Stock | unit | achievement metrics |
| | Uniform Stock | unit | achievement metrics |
| | Gloves stock | unit | achievementmetrics |
| | Glasses Stock | unit | achievement metrics |
| Checking Post | Contidition | Scale 1000 | competence metrics |
| | Life time | Time Function | diagnostic metrics |
| | Age | 25 years | achievement metrics |
| Filling shed | Condition | Scale 1000 | competence metrics |
| | Life time | Time Function | diagnostic metrics |
| | Age | 5 Years | achievement metrics |
| | Maximal Capacity | 100 KL | achievement metrics |
| | Volume | Filling Function | achievement metrics |
| Tank | Condition | Scale 1000 | competence metrics |
| | Life time | Time Function | diagnostic metrics |
| | Age | 10 years | achievement metrics |
| | Maximal Capacity | 100 KL | achievement metrics |
| | Volume | Filling Function | achievement metrics |
| Truck Car | Condition | Scale 1000 | diagnostic metrics |
| | Volume | Filling Function | achievement metrics |
| | Maximal Condition | 10 KL | diagnostic metrics |
| | Types | PM/PX/SO/MT | achievement metrics |
| Fuel | Selling Price | rupiah | achievement metrics |
| | Buying Price | rupiah | achievement metrics |

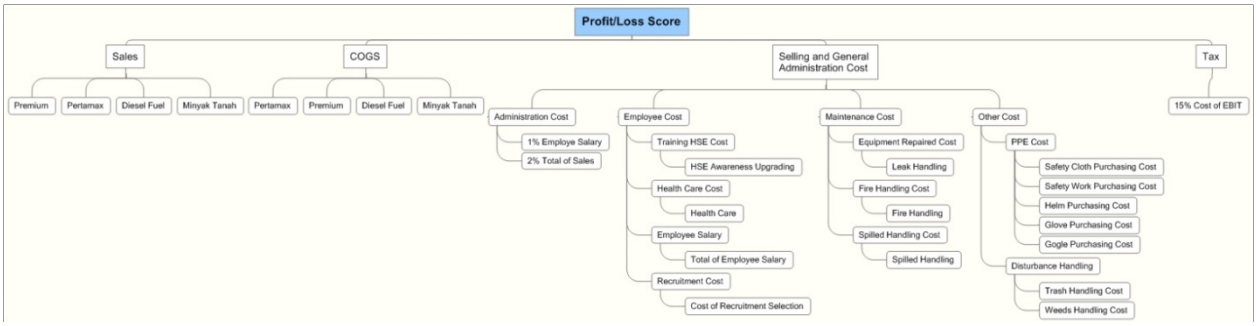

Figure 7 Hierarchy score of business model.

Figure 8 Hierarchy score of model safety.